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## Reimagine What You Already Know: Toward New Solutions to Longstanding Problems

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### Introduction

Knowledge and technology can combine to change societies dramatically, opening opportunities that were previously unthinkable. But creating the right combinations and providing access require a particular blend of planning and luck; such points in time are rare and should not be missed. We are at such a historic point in Africa right now, where information and communications technologies (ICTs) have brought forth impressive innovations that have developed new solutions for longstanding problems. These developments have moved some to issue bold statements in which Africa should skip industrialism entirely and leap directly into the information era (Barlow 1998). A few years ago, this sentiment might have seemed far-fetched, but now new futures can be imagined that might just show that “the rise of 3D printing could do for Africa what semicon-

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ductors did for Taiwan in the 1960s” (Juma 2014). In fact, the statement highlights once more how a previously agrarian society—Taiwan—went from being a producer of mushrooms and shrimp to a leader in creating new value with technology. Juma outlines a powerful phenomenon called leapfrogging—the significant jump from one step in an economy’s evolution to another, skipping a few steps in between. ICT is doing exactly that for Africa right now.

In Kenya, this is especially true in the case of the homegrown M-PESA, a mobile money transfer platform that has radically reduced transaction costs of capital exchange. In a remarkably short period of time, people in developing nations, who until recently lacked access to formal financial services, now have ways to connect to the global grid of financial flows and clearing of transactions. Instead of painstakingly developing a traditional banking sector—with decades of wasted human lives and opportunities—the introduction of mobile technology unexpectedly brought a completely new solution to a generation of people hungry for the chance to participate in the global economy *right now*. But the solution did not stop at facilitating transfers and transactions; on the contrary, the reduction in what economists call “transactions costs” kicked off an entirely new industry, developing new ways to enable mobile money to disrupt industries and business models. In times when the minds of state officials, industry experts and business owners are preoccupied by other pressing challenges, ingenious new ways to solve longstanding problems can set off a domino effect that changes society and the economy at large in ways that allow an entire country to leapfrog the traditional barriers that vex development.

Education, arguably the backbone for innovation and economic development, is ripe for leapfrogging. Although innovators are seeking new ways to educate the next generation, the difficulties of delivering adequate educational services to those without the means to afford expensive private schools remains a crucial problem. Even though the physical classroom with a standardized curriculum and textbooks has worked for many, it may well not be the timeliest response for the next generation of students. Without adequate access to both foundational and specialized knowledge, many will remain held back from the potential that the future has to offer. In turn, inequality will be on the rise and most likely exclude rather than empower many Africans. As African economies become the

narrator of homemade stories on economic success and development, new educational solutions need to ensure that the broader public will be able to latch on to the opportunities made available by rapid growth.

Because the education sector relies on traditional learning models and has only slowly opened up to the power of modern technology, we need an approach that *reimagines* education from the ground up. In other words, the whole learning experience, including the physical “place” of learning, needs to be up for new solutions. Once people take education out of the four walls of the traditional classroom into homes, libraries, internet cafés, and other places (Collins and Halverson 2009), a completely new learning experience is imaginable—one that innovators need to harness now in order to *transform* the way in which education is delivered in Africa. The “digital” setting will not face the same constraints as old models, and students will decide what, where, and when to learn. We need these digital models to start reimagining education in Africa.

In this chapter, we build a case for such an approach in the education sector. We start by introducing the sharing economy, recent advances in the open source movement, and the power of the internet, all of which provide key tools to put leapfrogging into action. Ultimately, the idea is that by carefully combining insights of different advances in technology and business-model innovation, new opportunities will be uncovered that allow a reimagination of the traditional, resource-intensive classroom model. We will reimagine several elements in the education sector, including school management, the classroom, the learning experience, and certification.

These elements are just a short list of the many innovations that, when brought together, start to fundamentally change education as we know it. We will use the insights gained from education to delve further into other industries—namely, logistics, finance, and health, in order to sketch out new innovations that reimagine products and services. The chapter will equip the reader with a specific analytic tool that can be and should be applied to other industries. We argue that the future for Africa resides in unleashing ideas and reconceptualizing solutions for longstanding problems rather than imitating outdated strategies from other contexts. In the next section, we take a step back and look at “the fundamentals,” that is, at the underlying conditions and economic forces that have created a context in which a reimagining will be fruitful.

## The Fundamentals

### Reimagining Ownership: The Sharing Economy

The self-storage industry in the USA has nearly 50,000 facilities, with more than 15 billion cubic feet of space (Clark 2014) cluttered with ... stuff. Americans and Europeans are storing bicycles, mattresses, and old televisions in facilities that may be more solidly constructed than many human habitations in developing nations.

But even in “more developed” nations, this abundance of stuff does not make sense. People do not fundamentally want physical things, which wear out and take up space. What they want is the *stream of services* that tools, clothes, and other physical things provide over time. People prefer owning things, ranging from tools to houses, rather than renting things because owning appears to secure services more reliably and at lower transaction costs than renting. But this preference for owning is not real. And it could change quickly if entrepreneurs can figure out a way to sell reductions in transactions costs. In a claim that looks prescient five years later, Suellentrop (2010) wrote, “We woke up in a Rentership Society, and it’s starting to look permanent. And you know what? Thank goodness. Ownership, it turns out, is for suckers.”

If you own something, you have to pay the *average* cost of using it, because no one can share it, and you have to pay for what it cost to create that thing. But why not just pay the *marginal* cost, rather than the *average* cost? If I already own a flat, I am already paying for utilities and making mortgage payments. But what if I am not always there, or if I have an extra room I almost never use except for storing junk? I would be willing—maybe even happy—to offer someone else my place to stay at the cost of having to clean it afterward, plus whatever extra I can get to pay toward my rent. I am willing to offer rides in my car at the cost of gas, my time, and wear and tear on the vehicle.

The reason we do not see more sharing is “transactions costs.” There are some people who have an extra room, and others who need a place to stay in a strange city. What is missing (Munger 2015) is: (1) information about identity and location, (2) a way of making payment that both parties can trust, and (3) a way of outsourcing trust on performance of the terms of the contract.

The usual answer to sharing a living space is “hotels,” because they provide all three of these needs. But hotels are expensive because they have to cover their average costs: all of their expenses are involved in the business of selling rooms by the night. That is not true of apartments or homes where people live, because those other expenses are being paid already. That is better for the buyer also, of course, as long as the three needs listed above can be satisfied reliably. The company called Airbnb figured this out, and sells a product based precisely those three needs. They do not rent out space: they sell access to renters to people who have space and access to space for people who want to rent. That means that the existing stock of “stuff” can be used far more efficiently. As transactions costs fall, which means as entrepreneurs find new ways to “sell” transactions-cost reductions, the status of much of what we now own will change. All of us will rent more and own less. Some of us may specialize in being “sellers” in these new rental markets for things we do own. But still, overall each of us will have actual possession of far, far less stuff at any given time.

## Reimagining Production: The Open Source Movement

An implication of this change—the change from selling new stuff to selling better access to stuff that already exists but is underutilized—is that more and more things will be “open source.” To understand what “open source” means and how we should think about it for education materials requires a look at some background.

Ironically, investigating the history of open source illustrates some of the problems and paradoxes at work. One of the ur-texts of open-source history is Philip Elmer-Dewitt’s article, “Computers: Software Is for Sharing,” published by *Time* magazine on July 30, 1984. If you can get access to it, you will see that the article describes the problem of splitting software from the physical electronic platform for which it was created. The reason we say “if you can get access” is that this article about free availability is behind a paywall at the *Time* website.

There may be good reasons for that. *Time* is providing a service to make the article available, and the author may still want the copyright to be enforced. In many cases, people write stuff to get paid. But how is

that kind of “stuff” different from the stuff piled up in garages and storage units? How can we make better use of all *that* kind of stuff, the kind that is made up of information?

The notion of open source is generally associated with software, but for a very long time, people in a variety of fields have recognized the underlying problem: information wants to be free.<sup>1</sup> “Free” might mean *libre*, or exempt from restrictions, meaning that there are no restrictions on publication or dissemination. But “free” also has the literal meaning of *gratis*, being available without charge, and available for use, reuse, and modification in contexts quite different from its creation or original use.<sup>2</sup>

Open-source software is freely available (including source code, not just compiled programs), freely reproducible, freely editable, and technology neutral.<sup>3</sup> DiBona et al. (1999) pointed out the analogy between software and information, using the narrative of the “discovery” of the double-helix structure of DNA. The passage is worth quoting at length:

The quest for the secret of DNA became a fierce competition between, among others, Watson and Crick’s lab in Cambridge, and Pauling’s lab at Cal Tech...The story here centers on Max Delbrück, a mutual friend who traveled between Cambridge and Cal Tech. While sympathetic to Watson and Crick’s desire to keep the discovery secret until all results could be confirmed, Delbrück’s allegiance ultimately was to science itself. In this passage, Watson describes how he learned that Pauling had heard the news:

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<sup>1</sup> This phrase, or the sentiment it embodies, is ancient, as Clarke (1999) shows. But the modern use in the context of software and widely disseminated information is usually dated to 1984, when Stewart Brand [creator of the *Whole Earth Catalog*] told Steve Wozniak [of Apple Computer]: “It seems like there’s a couple of interesting paradoxes that we’re working here .... On the one hand information wants to be expensive, because it’s so valuable. The right information in the right place just changes your life. On the other hand, information wants to be free, because the cost of getting it out is getting lower and lower all the time. So you have these two fighting against each other.

WOZNIAK: Information should be free but your time should not.

BRAND: But then, at what point of amplification is your time being so well rewarded that it’s getting strange or so under-rewarded that it’s strange? There’s problems there with the market.

Quoted in Brand and Herron (1985).

<sup>2</sup> See Clarke (1999) for more on the distinction.

<sup>3</sup> The full requirements to qualify as “open source” are more extensive, and more technical. See Open Source Initiative (n.d.).

Linus Pauling first heard about the double helix from Max Delbrück. At the bottom of the letter that broke the news of the complementary chains, I had asked that he not tell Linus. I was still slightly afraid something would go wrong and did not want Pauling to think about hydrogen-bonded base pairs until we had a few more days to digest our position. My request, however, was ignored.... Delbrück hated any form of secrecy in scientific matters and did not want to keep Pauling in suspense any longer.

Clearly the need for secrecy made Watson uncomfortable. One of the poignant themes that runs throughout the book is Watson's acknowledgment that competition kept parties from disclosing all they knew, and that the progress of science may have been delayed, if ever so slightly, by that secrecy. Science, after all, is ultimately an Open Source enterprise... [U]ltimately the process of discovery must be served by sharing information: enabling other scientists to go forward where one cannot; pollinating the ideas of others so that something new may grow that otherwise would not have been born.

There is a further analogy, one that is clear to anyone who works in education or who has tried to become educated: the fact that information is available does not mean that students have learned it. But the more expensive information is—in either the sense of not being *libre* or not being *gratis*—the harder it is to learn.

The problem is clear, but seemingly intractable. Society wants, and in fact needs, for individuals to have reasons to discover new information and to create new software. We have to cover the average costs of this valuable service. Once that new information is discovered and once that software is written, that information “wants” to be priced at marginal cost. In the case of data, source code, or ideas, the notion of any positive price is difficult to sustain. The cost of dissemination is a few keystrokes, an internet connection, and space to store the digital content.

For these reasons, the roles of collection, curation, and organization have become central to the development of new platforms for education and means of disseminating information. In economic parlance, these are “middlemen.” The role of the middleman has always been ambiguous: crucial, yet destructive, seen sometimes as valuable and sometimes as an obstruction to progress. We turn aside for a moment to consider the role of middlemen as entrepreneurs and revolutionaries.

## The Middleman and the Information Revolution in Education

Joseph Schumpeter (1942) famously described entrepreneurs as destructive: “Entrepreneurs are innovators who use a process of shattering the status quo of the existing products and services, to set up new products, new services.” This is something more than arbitrage or making money by buying low and selling high. Rather than simply “correcting” errors in the price system and causing the convergence of prices of a single existing commodity, entrepreneurs imagine alternative futures, new products, and possible ways of organizing production.

It is difficult to overstate the importance of this distinction. An entrepreneur does not (just) take advantage of errors (i.e., differences) in prices. An entrepreneur is alert to entirely new possibilities, to products and innovations that consumers may well not even be aware that they could have, much less want. Steve Jobs, of Apple Computer, famously observed that entrepreneurs could not rely on static conceptions of “demand”: “You can’t just ask customers what they want and then try to give that to them. By the time you get it built, they’ll want something new.” (Burlingham 1989).

A decade later, Jobs went further: “But in the end, for something this complicated, it’s really hard to design products by focus groups. A lot of times, people don’t know what they want until you show it to them.” (Reinhardt 1998). This echoes Henry Ford’s famous, though perhaps apocryphal, claim that: “If I had asked [consumers] what they wanted, they would have said, ‘Faster horses!’” (Vlaskovits and Ford 2011).

For our purposes, this notion of entrepreneurship is crucially linked to the changes in the forms and availability of information. Traditional models of education are likely to be destroyed entirely and replaced, rather than changed at the margins. But this transformation can only take place if the information being passed on can be both free, and yet, conveyed in ways that compensate both creators and educators—which brings us to the middleman.

We tend not to like middlemen. They seem parasitic, buying products and then reselling them without improvement. If middlemen make profits, surely they do not earn them. And in fact, “eliminate the middleman”



is the maxim of many simplistic schemes for increasing profit or reducing costs. Why do middlemen exist?

The answer is that middlemen make possible transactions that otherwise could not take place. Transportation, information, assurance of quality through brand name, financial clearing services—all of these are means of making possible transactions that otherwise would be blocked by transactions costs. An example makes this clear. Suppose that A is willing to rent widget W for any price over USD40 per day. B wants to use W for a day and will pay any price less than USD75. In principle, there is a bargaining space where any rental offer greater than USD40 and less than USD75 makes both parties better off. And in a social sense, W “should” be used by B, because he values it more than A.

But A may not know where or even who B is, and it is expensive to go looking. They may be physically distant, meaning that there are transport costs. The medium of exchange may be cumbersome, requiring costs to clear the transaction if it takes place. And they do not trust each other: say W is valuable and A is not sure B would not break it. These costs could easily be USD50 or more. Assume the transactions costs are split evenly, USD25 each. That means that A will require a payment of at least USD65 to sell W, and B will pay at most USD50. There is now no price where the transaction can take place. And because of this, A and B may not even imagine the idea of renting widgets. No one has ever made an effort to set up a widget rental company, and no effort has been devoted to developing institutions for reducing the transactions cost.

To succeed, a middleman has to reduce three key transactions costs: (1) provide information about options and prices in a way that is searchable, sortable, and immediate; (2) outsource trust to assure safety and quality in a way that requires no investigation or effort by the users, and (3) consummate the transaction in a way that is reliable, immediate, and does not require negotiation or enforcement on the part of the users.

It is tempting to think that the reason that Uber, a mobile ride hail company, has succeeded is that it avoids the costs of complying with the regulations, taxes, and restrictions that affect taxis. And that may be part of the story. But if you call an Uber driver, she appears almost immediately; you do not have to wait or wave at taxis that do not stop. That driver comes looking for you using the software and GPS features

in your phone. Further, you can see the name and license information of the driver and you know the company has the driver's personal and financial information. You do not need to give the driver directions, because you have already provided your destination to the software, which the driver can then use to navigate while you think about something else. And the driver is paid, and tipped, without you having to touch your wallet. Finally, you get to rate the driver and the ride, and Uber pays for background checks. Drivers whose ratings drop below a threshold, which varies by location, are fired.

Thus, it is important to recognize that the changes we are observing are not simply driven by passive, exogenous changes in transactions costs. Ronald Coase (1937) was rather scornful of the notion that transactions costs were a definable, measurable variable that should be seen as driving economic change. The key factor is the innovation in software platforms that reduce the costs of the entire transaction to the point where that activity is now profitable for the entrepreneur and beneficial for the consumer. The transaction is paid for within the software itself, and both you and the renter (who may just be a private citizen who happened to have a drill) will rate each other. Services like this already exist in many cities for high-quality bicycles, luggage, clothing, and appliances. As transactions costs are reduced by software platforms, enormous value is created for consumers and entrepreneurs grow rich.

The question is how, or maybe if, this model can be adapted to education. The challenges are daunting, and the potential for "success" carries with it the likelihood of massive disruptions in existing means of delivering information. Let us see why.

## Reimagining Education

### Traditional Education

The importance of developing one's mind has been appreciated for millennia, but only recently has the chance to learn in a structured manner been afforded to the masses. Alexander the Great is reputed to have said, "I am indebted to my father for living, but to my teacher for living well."

(Vries 2014). Alexander's teacher was, of course, the legendary philosopher, Aristotle. So Alexander was also indebted to his kingly father for having the resources to be able to afford such a teacher.

But Aristotle has been “teacher” to millions of other people, long after Alexander had also become a legend. In the years between the Greek philosophers and the invention of the printing press, Aristotle's works were kept alive by armies of scribes, hired by the Library of Alexandria in Egypt to copy and preserve any written works passed through the port. After that library's destruction, other institutions, most notably the Islamic House of Wisdom in Persia, carried on the great tradition of preserving knowledge (Al-Khalili 2011). That tradition, working its way through medieval scribes in European monasteries, was eventually brought to America by the scientist-businessman-diplomat Benjamin Franklin (Korty 1965). It scaled up with the fortunes of industrialists-turned-philanthropists, like Dale Carnegie. Thus, for nearly a century, a large percentage of Americans have been able to take for granted free or low-cost access to a wide variety of books and related services (Harris 1999). The same does not hold true for much of the world.

We may not think of books as technology, but they are. Even paper is a software technology: the English word is derived from the word “papyrus.” We often forget how remarkable it is that technology enables us to copy books and move them through time and space so easily. In the ancient libraries in Egypt and Persia, each work had to be copied by hand by an educated scribe. Written works were thus valuable and rare. In Europe, the majority of such efforts centered around copying bibles onto expensive vellum in candle-lit basements of churches and monasteries, which incidentally ran a large number of schools (Harris 1999).

When Gutenberg's printing press started production in Germany around 1440, it quickly transformed the position of the Catholic Church by making the Bible available to the masses without the control and interpretation of the clergy (Eisenstein 1979). When, in 1517, Martin Luther nailed his “Ninety-Five Theses” (condemning many practices of the church, such as selling indulgences) to the ornate main door of the Schlosskirche in Wittenberg, his challenge was written, not spoken; the handwritten manuscript was printed and then spread rapidly through Europe. Thus, with the aid of some wealthy friends and the technology

of printed paper, one man helped spark the Protestant reformation (Eisenstein 1979).

The printing press was also a revolutionary instrument in the development of science, as well as a revelation. The printing of treatises and journals allowed ideas to be developed at length and understood and debated by people distant in space, and even time, from the writer. As intellectual communities grew, it became possible to settle disputes about competing theories by dramatically increasing the number of minds focused on a problem. It became possible to teach students about what was already known. Scholars no longer had to start over with every new generation; science became cumulative in education and incremental in research. Ideas could be spread through libraries, and new ideas could be accumulated through spreading networks of universities (Eisenstein 1979).

Still, education was mostly available to only the elite because the technology of printing and the use of vellum were still very expensive. The basic technology of producing books improved slightly in the eighteenth and nineteenth centuries, with production-line methods and improvements in the production of high-quality, low-cost paper, but books and paper were still expensive to produce, transport, or store, and all but the highest-quality bindings and paper degraded in just a few decades. The truly revolutionary change took place in the late twentieth and early twenty-first centuries. It was at this point that information, words, and educational material were divorced completely from having any physical medium. Digital information, once produced and stored on a magnetic or other medium, could be infinitely reproduced in ways that are very nearly costless, and transmitted around the globe in ways that are very nearly instantaneously. Though we cannot speak directly with Aristotle the way that Alexander the Great did, almost anyone can now instantly have access to Aristotle's works on a mobile phone, from practically anywhere on the globe. Aristotle has more readers—and a greater impact—today than anyone could have imagined during his lifetime or in the Middle Ages, when he had to be read in Greek or Latin from a handwritten manuscript. But more importantly, Aristotle can now be read, in almost any language, by anyone who has a screen and an internet connection.

Nonetheless, most schoolchildren do not read Aristotle. One aspect of such educational materials remains elite: priority. The level of education, and the breadth of knowledge, required to make the careful study of

Aristotle a core priority is beyond most communities. Fortunately, the same technological revolution that divorced information (sometimes called “content”) from medium works for the basics of algebra and grammar. What until now has required the expensive printing and shipment of fragile, heavy textbooks, which can wear out or become obsolete, can now be achieved through digital learning resources—often called open educational resources when they are truly free. Teachers, like scientists, can benefit from someone else’s work and teach students using materials other people have developed.

As a result, a new kind of modern learning experience is being born. And the consequence is that many things we imagine we know about education are being called into question. We can all imagine a classroom with a trained teacher standing at the front and silent students taking notes or working on exercises from a textbook. We all know that each school needs an army of administrators, from the principal on down, to make it run and keep the teachers in line. We all know that a highly skilled teacher with years of training needs to stand up front and maintain discipline so that the children can be molded. We also know that the learning is certified through a series of tests followed by the issuance of a paper diploma—turning years of mental toil into a series of numbers and letters (grades) with a brand name (the school’s name) and logo on the top.

The question is which, if any, of these features of education are essential for the future we now need to reimagine. Just as Airbnb has reimagined hotels, the Open Source movement has reimagined production and ownership of intellectual “property,” and the Internet has reimagined distribution, so, too, are groups and entrepreneurs attempting to reimagine education. Some are reimagining the classroom, others are reimagining school administration, others reimagining the learning experience itself, and still more are taking a fresh look at the certification process with new ways to document learner effort and achievement.

## Technology-Driven Education

Traditional education has had many successes, and the way traditional education has been conducted is based on centuries of experience. But recent changes in capacities and a dramatic expansion of needs have

created a setting where reimagining may be fruitful. There are several technology-driven innovations that have been tried in a number of places, and there is great promise of success if change can be managed. The primary focus of our discussion will be on East Africa. We will consider the disruptive capacity of these innovations and their potential impact on the most marginalized communities. Hopefully, change-makers will be able to take and remix some of these ideas and help in bringing forth a new era of learning. The space is complex, but headway is being made.

Traditionally, classrooms are physical locations in which a single trained teacher and a larger number of students show up at the same time to produce what we call education. But over the past decade, Massive Open Online Courses (MOOCs) have been released online—either free or at a very low monetary cost—allowing learners with Internet access to see lectures from top universities. Unlike in a traditional classroom, learners watch videos online from a (possibly remote) location; take quizzes that can be automatically graded by software; and submit assignments, such as essays, which are often peer-graded. Learners receive certificates with the name of the MOOC provider (such as Coursera, EdX, Open2Study, or Udacity) as well as the university that the professor is affiliated with (such as Stanford, Harvard, or MIT). Though completing a MOOC does not normally confer university credit, many universities allow enrolled students to earn credit by taking online courses in lieu of traditional classes (Boven 2013).

These innovations have also moved into classrooms for younger learners in primary schools. Khan Academy, a nonprofit organization, developed a collection of free videos covering a wide range of subjects, like math and science, which were first released on YouTube (Khan 2013). Classrooms around the USA have been “flipped,” as students watch videos at home and then do work in class, where the teacher can help minimize the time the learners spend struggling (Berrett 2012).

These technology-enabled innovations have moved classrooms out of their traditional physical location and thus changed the learning experience for many. Despite these significant advances, data show that those who complete courses tend to be relatively highly educated, with university or Master’s degrees. For now, the people thriving in the new digital classrooms are the same people who already thrived in traditional classrooms (Ho et al. 2015).

But there are other possibilities. Here are three examples of organizations that have reimagined education.

*Example 1. Bridge International Academies: Reimagining School Management*

Traditionally, a “school” requires a bevy of costly administrators and support personnel to operate. Bridge International Academies is a Nairobi-based chain of low-cost primary schools. They are the fastest-growing chain of private schools in the world and have secured investment upward of USD100 million, including a high-profile investment of USD10 million from Facebook’s founder, Mark Zuckerberg (Stavis and Clark 2015).

As did industrial companies of the past, Bridge uses economies of scale and standardization to dramatically lower costs, to provide low-income families an alternative to government-run primary schools in Kenya and other parts of Africa. Like a highly efficient Amazon distribution center, Bridge uses software and data to monitor thousands of teachers in hundreds of schools. Lesson plans are centrally created in Boston by an elite team of top teachers and are distributed, using the Internet and mobile phone networks, to e-readers which teachers use to deliver scripted lessons (Rangan and Lee 2010). This standardization allows less-trained adults from the communities to become teachers and the software enables tracking of lots of data, such as how fast digital pages are turned on the e-readers and how students in various classes score on exercises. Bridge can also use A/B testing, a technique used widely by tech startups and digital marketing firms, to give a different lesson plan to different sets of teachers and see which has the greatest impact on students’ performance. Were Bridge to open up their curriculum, they could also have examples improved and kept up to date with crowd-sourced input, just as Wikipedia articles are improved and updated.

Using mobile money networks (such as M-PESA in Kenya) to pay teachers, staff, and suppliers alike minimizes administrative overhead at each school, decreases opportunities for administrative fraud, and presumably decreases the risk for a robbery incident. Maintaining control and standardizing the education experience across schools has allowed Bridge to make great headway in providing low-cost primary education at scale by reimagining how schools are administered and how teachers are monitored.

*Example 2. Tunapanda Institute: Reimagining the Learning Experience and Teacher Training*

Traditionally, learners listen to lectures from highly trained teachers who are much older than the students and far removed from their own learning experiences. Tunapanda Institute is now reimagining the learning experience and teacher training by empowering relatively inexperienced young people in East Africa to teach each other within the context of a flexible curriculum focused on technology, design, and business skills that help young people enter the workforce as professionals, become innovative teachers, and someday engage in entrepreneurship.

The nonprofit organization (in which both authors of this chapter are involved, as founding director and co-founder, respectively) operates a training facility in Kibera, a large Nairobi slum, for young adults (from 19 to 25 years old). The facility recruits and trains young people from the area and similar areas around Kenya, Tanzania, and Uganda. After three-month intensive training courses in technology, design, and business, most graduates find jobs, normally as teachers or working for technology companies.

A few graduates, however, are selected to remain as apprentice-teachers and train future cohorts while learning to take over the operation of the facility. The system works because the curriculum is designed to be practical and hands-on. Rather than working to pass tests and earn higher grades, learners work in teams to program video games, build educational websites, prototype Android apps, and present startup pitches. Each activity ends with a presentation that is attended by a larger team. Because learners derive intrinsic joy from the activities and also want to look good when presenting to the group, high levels of engagement can be maintained despite very few formal rules or a grading system. Past graduates who are working in industry also return to share the value they derived from what they learned at Tunapanda, validating the program.

The peer-to-peer learning experience, where some young people are teaching the classes to young people, and both students and teachers are judged primarily by their peers, creates a different learning experience that many say provides more value over a shorter period of time than other available learning avenues, including local universities. Because teaching and coaching are also viewed as learning activities, graduates of former classes want to be a part of teaching and coaching their favorite classes at



least one time after they have gone through the program—meaning there are 3 to 4 more experienced trainers and coaches working with a cohort of 25–28 first-time learners.

By reimagining the learning experience, young people are able to envisage a transformation in their future and become not just lifelong learners but also lifelong teachers.

*Example 3. Mozilla Open Badges: Reimagining Certification*

Traditionally, certificates are issued by the learning institution, with external testing authorities in some way validating the learning through testing. Examples include the Scholastic Aptitude Test SAT and Advanced Placement examinations in the USA, and the Kenya Certificate of Secondary Education (KCSE) examination in Kenya. These grades and exam scores are used as an important means of helping universities decide who to admit, helping governments decide who to fund, and helping employers decide who to hire.

Mozilla, the nonprofit entity most known for maintaining the open source web browser Mozilla Firefox, began an initiative to create an open badging system. Just as Uber uses a rating system to show the quality of drivers and passengers, Mozilla's Open Badges system could let others know about the quality of your work for more complex tasks. Mozilla manages "participating issuers," who are able to design and issue badges if users are able to demonstrate proficiency.

The importance of these badges being "open" cannot be understated, especially in the context of enabling people in less-developed countries to earn higher incomes. Currently, Uber's rating system is closed, that is, the experience ratings earned in the system by either a customer or a driver cannot be taken to, say, Easy Taxi (an Uber competitor) or Airbnb. As work evolves and people begin to piece together income-earning activities, rather than having a single "job," the ability to take one's rating system from platform to platform becomes highly valuable. Not only might these certification systems enable someone in an African slum to earn income doing digital work for someone living in Beverly Hills, the systems might also enable people to access credit markets and even gain access to a foreign country.

Although the execution quality of Mozilla Open Badges and other badging systems remains to be seen, the ability to connect educational

certificates directly to a portfolio could open a range of new paths into modern global professions.

## Conclusion

The U.S. space agency, National Aeronautics and Space Administration (NASA), demonstrated the power of technology when it designed a needed tool, a ratchet wrench, on Earth and then sent the model to the International Space Station where it was 3-D printed and used. “In less than a week, the ratchet was designed, approved by safety and other NASA reviewers, and the file was sent to space where the printer made the wrench in four hours,” reported Niki Werkheiser, the space station 3-D printer program manager (Harbaugh 2014).

Humanity stands to gain a great deal by leveraging technology to create more inclusive economies and engage more people in solving both hyper-local and global problems. Although it took centuries to go from the invention of the printing press to making books widely accessible around the world at low cost, today, software can be written in Kenya and then downloaded anywhere else in the world within seconds. The same is true for textbooks, test banks, and videos of lectures or presentations: Space is no longer a barrier and time for transport is no longer the cost for the transmission of ideas and information.

But there are many other barriers, and costs, that have yet to be managed or surmounted. A MOOC is of little help to rural schools that lack electricity or an Internet connection. Learning to write code on paper is no substitute for writing and debugging actual programs on a computer. The widespread availability of digital tools and free or open learning resources does not mean that opportunity will spread to all of the ten billion humans expected to inhabit our planet by the end of the twenty-first century. UNICEF (2014) predicted that by the middle of this century, 40 % of the planet’s children will be in Africa—a prediction that highlights the urgency of using successful leapfrogging education solutions in the region.

One computer can “teach” another simply by transferring code, instructions, and content files, copying identical information repeatedly. Human education does not work that way—information in the brains of children

and young adults is acquired by learning from a teacher, not downloading. But the technology of teaching is not fixed; the tradition of a teacher, managed by administrators, in a physical building, dealing with students who are seeking a well-defined terminal degree in a set curriculum and whose learning is verified by standardized tests, is changing. For the less-developed world to develop further, it will be necessary to leapfrog over the gradual development of physical facilities and infrastructure (such as reliable electrification and Internet connections) and skip ahead to a more decentralized environment where almost everything is open source.

Poor people are not lazy; uneducated people are not dumb. The world is full of humans who would like to take part in creating value and solving problems, but just have not had access to the type of learning experiences that develop such skills. The shortage of teachers, the chronic problem of many regions, might be solved by giving students access to lectures from the greatest teachers in other countries, using digital preservation and transmission, or by enabling students to teach each other using software designed partly by previous students who understand local conditions.

Although there is no unique magical combination of imported foreign and dedicated local materials that make up a successful ICT, the solution does lie in some such combination. The reimagining of production, distribution models, financial services, and systems of education by innovators and entrepreneurs can help create a much more prosperous and inclusive future. But that future is not guaranteed—it still needs to be created.

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# Conversation #5

## To Keep Disrupting, You Have to Listen Closely to What the Client Wants

Elizabeth Rossiello of BitPesa



***Elizabeth Rossiello** is the founder and chief executive officer (CEO) of BitPesa, a Pan-African digital payment platform that uses bitcoin for settlement with its international partners, enabling low-cost international payments and transfers. Before founding BitPesa, she was the deputy director of Planet Rating's East and Southern African office, conducting microfinance institutional ratings and analysis across the region. She started her career at Credit Suisse in New York, London, and Zurich, and worked at Goldman Sachs and the German Bundestag as a Robert Bosch Fellow. She is an alumna of Columbia University's School of International and Public Affairs. She speaks four languages and has two children. Elizabeth is a native New Yorker but has lived in Kenya for the last seven years.*

### **What is the story behind BitPesa?**

We began BitPesa with a focus on developing a remittance product that reduced the average cost of sending money to Kenya from 12 % to 3 %. We wanted to replace traditional money transfer services by having senders purchase bitcoin in their origin country via an exchange and selling it in their destination country to us. Our first corridor of focus was the UK, specifically working with the Kenyan diaspora, who we believed sent home regular remittances to support household expenses for their families and friends.

What we learned, however, while we were doing our focus groups and talking to customers, was that many in the diaspora were actually sending money to themselves. We started to question the term “remittances” and wondered how much of the USD1.4 billion sent to Kenya was for families and friends and how much was for small and “home” business operations and investments. Many in the diaspora whom we spoke with were sending money from abroad to their own accounts in Kenya. They would then use this money to invest, pay salaries, or buy supplies for businesses they ran semi-remotely.

A lot of our early customers were young businessmen, between the ages of 18 and 35, who understood how the technology can be used to run more efficient businesses. They were tech savvy and really excited about a new, digital way to send or collect payments. Our customers could not use credit cards for their purposes, and mobile money was not working internationally for them. Before BitPesa, these customers would often have to use middlemen, fixers, *hawala* (traditional informal broker networks), or expensive bank transfers to run their businesses.

We create liquidity in markets where there was previously low liquidity or only liquidity if you used informal cash payments. We buy or sell African currencies at a better price and quicker settlement than local banks can offer. Now businesses working in or across Kenya, Tanzania, Uganda, Nigeria and the DRC can easily make or receive global payments from their African currency banks and mobile money accounts. BitPesa accepts local bank transfers in local currencies and pays our bitcoin to global brokers to settle in foreign bank accounts in foreign currency. Bitcoin is used only between the brokers,

removing any volatility from the end-user experience. Payments start and end with local bank transfers.

**What other user cases did you identify?**

The initial product was started without necessarily a user-centered design. It imposed a use case on the customer, suggesting that there was a personal or social connection for payments. Our latest iteration introduced more business and trading features to support our users' buying and selling bitcoin for commercial uses. We also offer bulk payments, bank transfers, and quicker trading times. We marketed these features as "BitPesa for Business." Before using BitPesa, these businesses told us, they had to deal with many counterparties, both banks abroad and in Kenya, as well as mobile money providers. They either went through multiple aggregators or spent time and money building custom integrations. They experienced forex (foreign-exchange-market) losses associated with long settlement times and were forced to hire more staff and oversight to facilitate international and domestic steps of the payment process. By using BitPesa, they have a one-step option of sending international payments into local African currency accounts; either in one country or across several countries.

**How easy was it to establish a new and disruptive technology in the market?**

It is hard to be one of the first adopters of a new technology. There are few people to compare notes with and share the task of educating regulators and potential partners. When we started BitPesa, I continually heard the message that "Kenya was not ready for bitcoin." This surprised me, especially because I heard it from members of the ICT community and innovation teams at local banks. Kenya is famous worldwide as an innovator in digital payments. But in the end, we saw super-fast uptake of the product in focus groups.

To stay motivated and on track, we used a customer-centric approach. Even if a potential partner did not believe the market was ready, we listened to our customers in product sessions and demos. We looked at our growing transaction volume rather than the opinion of managers in traditional financial institutions.



**How did you find out what your future customers really wanted?**

In early 2014, we started to organize meet-ups at the iHub in Nairobi. These were casual meetings over samosas and beers, where we talked about bitcoin and BitPesa. We held demos and traded between friends. The first meet-up was with five people who already knew about bitcoin. The next meet-up was with 20 people, and then, the next was with 40. In a few months, we had a long contact list. At our kick-off party during the World Cup, we had 170 people and we had only a skeletal product. But all of these people were really excited about it!

Simultaneously, we had team members in London meeting regularly with community leaders in the diaspora community. We held market research sessions, teach-ins, and demonstrations. We were ever-present in the community through agents and brand ambassadors. We had a large funnel of information from our contact with potential customers. I saw what the customers wanted—I mean, real people who wanted to use it from day one. So even if someone said, “Oh, they’ll never like it” or “That doesn’t make any sense” or “You don’t know the market,” I would then go back to the focus group and people would tell me the opposite. So I would just listen to the customers rather than the talking heads and partners.

**What is the future for digital assets?**

I believe that money transfer operators and telcos, companies like MoneyGram and Safaricom, will use decentralized payment systems and adopt technology like bitcoin in the next five to ten years. All of the major banks, payment companies, and FinTech companies are filing patents, making investments, and developing products. Billions of dollars are being spent on exploring the use of this technology. Those products will enter the market in the next few years and leave all the other companies behind that refused to take the time to understand the technology.

People are not going to send physical cash when they can send digital cash. A bank in Zambia and a bank in Hong Kong need to communicate in the same way. You cannot expect that a local mobile payments company, like Zoona in Zambia, will have spent the time and money to integrate

with a digital e-money network based in Hong Kong. All of these local companies need one uniform rail to link into and act as a decentralized ledger. I do not think that the global payment infrastructure should be owned by a single company, like Mastercard or Vodacom, but rather, use decentralized ledger technology to be robust, secure, and unbiased.

**How much could you rely on investments from Kenya to finance BitPesa's operation?**

I would love to have had local investors invest the whole amount, but I have not found that much financing available for FinTech (financial technology) start-ups. I would love to have not traveled so much away from my family and my business to find investors. There are very few early-tech investors in the region. We have just received financing from a few Nigerian investors, which is exciting because their expertise is essential to our growth across West Africa.

**What do you think is the missing puzzle piece to get more Kenyan or African investors on-board?**

Well, there is currently a lot of opportunity in relatively familiar investment options, like real estate. So why would an investor go into an unfamiliar, and seemingly higher-risk, area like tech? Why would they want to invest in a “very first of its kind” business? We still need to see more buyouts and M&A activity in the sector—some successful exists. I think those exits will act as data points for Kenyan and African investors to realize that FinTech is a viable investment opportunity.

**You are one of the few tech companies with a female executive team. Was that a coincidence or a deliberate decision?**

I hired people that were talented and experienced and that I was convinced would work hard to build something new. In Kenya, you often find tech start-ups with groups of friends from high school. I did not go to high school here, so my first hire was a fellow financial services consultant, Charlene Chen, with whom I had worked on a few projects over the years. Similarly, our second hire was forex trader Amy Ludlum, who had a stellar finance background at a major global bank but was highly motivated to work for a start-up. Once we had three women leading the team,

we became a magnet for other talented female professionals who knew there would be nothing standing in their way for career advancement. We now have a 50/50 gender split and work hard to create an exciting and rewarding environment for our team.

We have tried to build a company that is fair, open, and welcoming. We do work very hard and expect all our team to perform at a high level. However, we reward our employees for their work and dedication.

### **What excites you about Kenya's tech scene?**

It is interesting to be in Kenya at this particular time. I mean, there are a lot of hardworking people who are very entrepreneurial and starting these amazing businesses. I feel honored to be part of it. I think the banks have a hard time keeping up with all this innovation. There is just so much innovation coming out of this ecosystem. People are almost like, "What do I focus on next? An e-ledger or new digital money or something else?" I, however, wish there would just be way more support out there for entrepreneurs by other entrepreneurs. There are private clubs for the very wealthy, but nothing where techpreneurs get together regularly. We are a diverse group of women and men from all sectors living across a sprawling metropolis. We connect a lot over WhatsApp in a few techpreneur groups and are just now starting to organize events and meet-ups for founders across sectors. We are all really busy building our business. As our companies mature and our incomes rise, we can then start investing in the next wave. This is the next evolution! I think it is going to be even more exciting once the founders grow up and now are able to invest. It is an exciting time to see this graduation.

### **What was your biggest "Aha!" moment during your time with BitPesa?**

It came when we started to sell bitcoins. We struggled to project our first few months of sales numbers, because the product was so new to the region. We had an intern at the time who encouraged us to start selling bitcoin instead of just buying it as part of our first remittance flow. He told us his friends were interested in buying bitcoin and he had been trading informally. We started selling bitcoin, and our volume growth went through the roof! We asked ourselves, "Why didn't we do this four

months ago?” That was definitely an “Aha!” moment. It reminded me that I needed to keep my ear to the ground and listen to what the market wants—rather listening to what my bigger, financial institution partners think the market wants. To keep disrupting, you have to listen closely to what the client wants!

**Thank you, Elizabeth!**



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